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ABSTRACT

In the last 25 years, the continuous acceleration of technology use in society has produced significant changes which the founders of the present public education system did not foresee. As a result, the current system is not only inadequate by modern standards, but is maladapted for the task of carrying the United States into the future, a task which proliferating technology has made critically important. This paper explores the rationale behind this assertion, describing the past--and probable future--social and economic changes undergone by society which combine to mandate the redesign of American public education, and investigate the relationship of technology, past or present, to these changes. The paper further examines the impact of such transformations on the field of education, and suggests ways in which the American educational system could meet the requirements of a changing environment. Finally, the paper considers ways in which technology itself could be used to address some of the problems that it has created, and outlines an educational agenda which could meet the demands of the 21st century. (AEF)

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Education for the Twenty-First Century:
A Philosophical Perspective

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INTRODUCTION

The spread of "High Technology" throughout Western society has, over the course of the past century, wrought changes in our lifestyle (and its requirements) which our Founding Fathers could never have imagined. In fact, the continuously accelerating pace of this phenomenon has produced significant changes in the last twenty-five years which the fathers of our present public education system could not (and did not) foresee. As a result, we have inherited a system which is not only inadequate by any modern standards, but also woefully maladapted for the task of carrying our nation boldly forward into the next century, a task which our proliferating technology (and that of other nations) has made critically important.

This paper will explore the rationale behind this assertion, describing the past -- and probable future -- social and economic changes undergone by our society which combine to mandate the redesign of American public education, and investigating the relationship of technology, past or present, to these changes. It will go on to examine the impact of such transformations on the field of education, and to suggest ways in which our educational system could act to meet the requirements of the changing environment. Finally, it will consider ways in which *technology itself* could be used to address some of the problems *which it has created*, and to outline an educational agenda which *could* meet the demands which the twenty-first century will impose.

SOCIO-ECONOMIC CHANGE AND THE AMERICAN WAY OF LIFE

Throughout the early part of American history, all it took to make a decent, middle-class living was a little simple knowledge of "the basics", or "the three R's" and the willingness to work. The industrial revolution changed all that.

The assembly line ushered in an era of specialized labor *and interchangeable laborers*. The small-quantity, high-quality product of the individual or family craftsman gave way to the high-volume, lower-quality product of the factory. An individual who possessed all the earlier prerequisites for success likely found himself unable to start his own business (because the factories, with their economies of scale, were already driving existing small businesses under). Furthermore, if he tried to get a job at a factory, he was unable to dictate the terms of his employment (because the individual tasks were so trivial that anyone could do them, and any particular laborer could be replaced as easily (if not more so) as any particular machine. In fact, an *educated* (three R's-level) laborer often found it harder to get a job than an illiterate, because the factories could hire illiterates more cheaply and, as already stated, the tasks required could be performed by *anyone*.

The educational system responded to this by shifting focus. "More intelligent" (typically *wealthier*) students were taught "the basics", followed by "the classics" (Greek or Latin, Literature, Higher Math, etc.) in preparation for college. "Less intelligent" (*poorer*)

students, in contrast, were routed into "practical" studies (vocational training). This response had two major effects. First, it crippled America as the Land of Opportunity, by weighting the system for self-advancement in favor of those already "advanced". Second, it created a large number of functionally illiterate (vocational) "graduates" through de-emphasizing basic skills in favor of "practical" skills to "prepare them for their [assumedly inevitable] station in life".[1]

Both of these results had the ultimate effect of undermining the American Way of Life by limiting the number of citizens capable of partaking in the governing of the nation. Unfortunately, the system described above persists largely unchanged in today's educational practice, although progress has been made in theory, and in some model programs throughout the nation.

The destructive effects of this system on our democracy are continuously multiplied by the increasing technological complexity of our society. We live in an age where information is available more easily, and in a wider variety than ever before. Television, radio, telephones, and computers all act to bring the latest news on most any conceivable subject to our eyes, ears, and fingertips. Furthermore, technology acts to compensate for human deficiencies. We now use technology to correct (to some extent) for visual, auditory, mental, and motor impairments, to name just a few.

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[1] This view was advanced by many prominent educational theorists, such as David Snedden, Frederick Taylor, and Edward Ross. The resultant conception of education's role was to prepare students to be maximally efficient in the fulfillment of largely predefined roles. Teaching of skills which did not directly contribute to this end was considered superfluous and wasteful.

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Unfortunately, there is one "impairment" for which technology, by its very nature, will never compensate for, but rather aggravates: poverty. Technology costs money, and is, therefore, more available to the wealthy than the poor. Thus, the rich are able to use it to augment their natural abilities, and to obtain information, in ways which are unavailable to the general populace. This rather obvious effect combines with the structure of the current educational system to produce a vicious circle. An educational system which prepares the rich to be managers and the poor to be laborers perpetuates (and aggravates) financial inequity. It helps to assure that poor children will be no more able to partake of the benefits of technology to lift themselves into wealth, or even "middle-classness", than were their parents. Meanwhile, wealthy families are busily using the latest technology to amass more wealth, and to provide their children with continually better opportunities. Furthermore, an educational system which produces as many illiterates as studies have shown[2] is assuring that the above-described wealth of information provided through technology is unavailable to an alarmingly large proportion of our citizens and, since most of these are from the poorer classes, they are unable to use such information to advance their economic status.

The *status quo* was further upset by a major social change: the increasing freedom of women, and their expanding presence in the job market. Over an historically brief period, this

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[2] The most famous of these is probably *A Nation at Risk: the Report of the President's Commission on Education* (1986, Washington, DC: USGPO), which suggests that almost one fifth of our adult population may be functionally illiterate.

had the effect of almost doubling the number of workers competing for the same number of jobs, particularly in the lower-paying occupations.

The changes described above bring us head-on with the most significant effect of technology to date: its impact on industrial efficiency. At the same time that the educational system and "women's liberation" are filling the marketplace for low-paying jobs with more and more bodies seeking them, technology, particularly in the form of industrial robotics, is reducing the number of such jobs available. In fact, despite the best efforts of labor unions and social-minded managers, it is inevitable that jobs of this sort will ultimately disappear altogether. The progress of technology cannot be stopped or reversed, only slowed or set back. Implacable laws of economics dictate that, if it can be done more cheaply, it will; and the day is not far off when most simple, motor assembly tasks will be more cheaply *and more accurately* performed by industrial robots.

SOCIO-ECONOMIC CHANGE AND THE NEED FOR EDUCATIONAL CHANGE

At this point, the socio-economic disaster for which our present educational system is heading us should be growing clear. Fueled by a business sector historically in need of large quantities of unskilled or semi-skilled labor, it is producing a generation of lower-class workers which will be incapable of finding employment -- *any* employment -- by the middle of the next century. Additionally, this same system, which has historically needed only a small number of managers or "thinkers", has had no reason to develop the capability of producing the numbers of such people which will be demanded by the industry of the future. Suddenly, the limits on growth will be the number of *white*-collar employees available, as the role of the blue-collar employee will be filled by machines which can be added as quickly as finances allow and the market demands.

Thus, it becomes clear that our system of public education must change, to meet the changing demands of a "technologized" industrial society. Fortunately, the process is still young, and the changes which require this response are only beginning to gain momentum. Nonetheless, we must not delay in our work, for there is much to be done.

Ironically, the blueprint for the school system of the next century was drawn up, at least in part, by a scholar of the last century. As the twentieth century was dawning, John Dewey, who ranks among America's most significant educational philosophers, was writing of an

educational system geared toward the production of a society of "free thinkers". Dewey felt that the goal of education should be the preparation of young people to be "good citizens" of a participatory democracy. This included teaching them to develop their own ideas of what was "just and proper", and to act as agents of change when this conflicted with the *status quo*. He also stressed the importance of developing *problem-solving* skills, rather than the skills associated with rote memorization.[3]

It is precisely this sort of program that is required to prepare our youth for the society of the future. The system we adopt must ground them adequately in "the basics", so that they are capable of assimilating the information with which technology can provide them, but it must also provide them with the tools for manipulating this information, once they have it, to produce creative, workable solutions to industrial and social problems. Finally, it must provide them with a sense of social duty, of responsibility not only for their own welfare, but also for the welfare of the society they live in. In short, it must prepare *every* learner for the kind of role that no machine will ever be able to fill -- that of an intelligent, reasoning human being, both capable of being *and willing to be* a positive force for the general welfare -- because soon there will be no other roles to fill.

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[3] Other great philosophers of education, most notably William Kilpatrick, agreed. Kilpatrick ("Project Teaching", *General Science Quarterly*, 1917) felt that schools should produce citizens capable of creatively addressing social problems, rather than "interchangeable parts" designed to fit preconceived roles in the workplace.

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Fortunately, the same technology which is driving us toward the problem also offers at least part of the solution. Advances in the areas of motivation and computer technology, in particular, offer significant possibilities for fulfilling the new mandates.

First, in order to convey the sort of high-level learning associated with problem-solving skills, learners must be sufficiently committed to their education to remain in school at least through twelfth grade. Given the dropout rates experienced by schools at present,[4] this motivation is clearly lacking. Fortunately, developments such as Keller's ARCS model,[5] Wlodkowski's teacher characteristics,[6] and Malone's environmental prescriptions[7] are providing significant insights into ways which instruction can be made more appealing to the learner. Although these ideas have yet to be put into practice on any large scale, they have seized the attention of modern theory, and their influence should be felt in the classroom within the next few years. It is interesting to note that, once again, Dewey had many of the

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[4] Again, see *A Nation at Risk*.

[5] Keller, J.M., et al (1982). The ARCS Model of Motivational Strategies for Course Designers and Developers. Fort Monroe, VA: Training Developments Institute.

[6] Wlodkowski, R.J. (1986). Enhancing Adult Motivation to Learn. San Francisco: Jossey-Bass.

[7] Malone, T.W. (1981). *Toward a Theory of Intrinsically Motivating Instruction*. Cognitive Science, 4, 333-369.

same ideas almost a hundred years earlier,[8] although one may be given pause to think that they were never widely accepted (except in their misguided application to the vocationalist movement), and had to be rediscovered.

In addition to developing the motivation to learn higher-order skills, learners must be provided with tools which will allow them to do so. Clearly, the old stand-byes of textbooks and lectures, with the occasional audio-visual presentation thrown in, are ill-suited for conveying such advanced skills. Computer-based instruction, in contrast, offers great promise in this area. Computers may be used to provide realistic simulations of problem-solving situations in virtually any discipline. Each individual learner can interact with the simulated "environment" much more readily, economically, and safely than if each were expected to operate in the real thing. Obvious examples are readily available: compare the two approaches in teaching exploratory surgery, nuclear reactor operations, battlefield tactics and command, or criminal law.

Furthermore, computers may be programmed to respond to the characteristics of each learner, thereby personalizing the instruction both in style and pace of presentation. A foreign student with a limited grasp of English could be assisted by native-language prompts explaining the meaning of unfamiliar words or phrases encountered during instruction in (for

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[8] Dewey (and, later, Kilpatrick) were ardent proponents of what has come to be known as the "project method": the use of meaningful experiences and simulated real-world situations to engage the learner's interest, and to make school "a place to live, not just to receive lessons" (in Kliebard, H. (1987) The Struggle for the American Curriculum 1893-1958, New York and London: Routledge and Kaegan Paul).

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example) marketing and sales techniques. As a result, the student would not only have a better chance of learning marketing, but would also be improving her/his English vocabulary.

While this same effect could be produced using individual tutoring, it is much cheaper to provide a computer for each student than to provide a tutor for each. Additionally, a computer is far less likely to become exasperated by a student who cannot grasp the difference, after five explanations, between (again, for example) the terms "microcomputer" and "minicomputer" than is a human tutor.

Of course, there are several non-computerized techniques (most notably the case study method and its relatives,[9] such as role-playing) which can often be equally effective at teaching abstract reasoning skills as the computer-based approaches, with the additional strength of requiring interaction with other human beings, an assuredly important component of living in the "real world". The practitioner must beware of the temptation to use a computer-based approach for its own sake. In fact, a solution requiring human interaction is almost always *preferable* to a computer-based solution of equivalent effectiveness and efficiency.

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[9] Case studies are widely used in the Business and Military settings, because of their effectiveness at conveying the desired skills and/or knowledge with great economic efficiency. For an excellent discussion of this method, see *The Case Study Methodology and Instructional Development* (with Annexes #1-4), by Alexander Romiszowski (1989, Syracuse, NY: Syracuse University).

SUMMARY AND CONCLUSIONS

The rapid advance of modern technology, and its resultant (present and future) pervasiveness in our society, have left us with a system of public education which is no longer suited to the needs of society. Driven by the historical need of industry for large numbers of unskilled and semi-skilled laborers, our current system has adjusted to provide "vocational training" to those presumed to be "less intelligent". This training often results in the production of functionally-illiterate "factory fodder" from a disturbing proportion of lower-class and female students.

In the "technologized" twenty-first century, people trained in this manner will be unable to fend for themselves, much less participate in the governing of our nation. The functionally-illiterate will be unable to partake of the wealth of information which modern technology can provide. Furthermore, the type of trivial, manual labor for which their training prepared them will be increasingly (ultimately completely) taken over by industrial robots. The jobs which remain will be for "problem-solvers" and "decision-makers", roles for which the present educational system is preparing predominantly only wealthy males.

Clearly, we must redesign our educational system to meet the imperatives of the coming century. We must overcome the current perception of intelligence as a static *trait* which "some have and some don't". We must replace this notion with the concept of it as a

changeable *state* which we, through the judicious application of our craft (and *its* technology), may act to raise, even among the mentally handicapped, to a functional level. We must provide *all* our young people with basic language and mathematics literacy, so that they may acquire needed information. We must provide them with the tools to use this information to make decisions. Finally, we must teach them a sense of responsibility for their fellows, and for the society in which they live. We must create, a century after its conception, Dewey's "society of free thinkers".

While technology is largely responsible for the problem at hand, it also offers part of the solution. Recent developments aimed at creating intrinsically motivating learning environments, and the development of interactive, computer-based instruction, are two of the most promising tools for teaching problem-solving skills. We must be careful, however, not to neglect older "technologies", such as the case-study approach and role-playing, as they, too, offer powerful vehicles for instruction of higher-order, problem-solving skills.

If we heed the warning signs, we have adequate time to change our course before the storm is upon us. It will likely be at least fifty years before the last unskilled jobs are gone from the factories. Nonetheless, we must not be complacent. It takes time to change a system which has been in place for a hundred years. There will be resistance from those who cannot, or will not, see the changes coming. Perhaps most significantly, we must remember that, with the advance of *medical* technology, *we* may still be in the workforce in 2050, and we can be sure that our children will.